Ecological Risk Assessment Bulletins-- Supplement to RAGS

Suggested citation:
USEPA. 2001. Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment. Originally published November 1995. Website version last updated November 30, 2001:
http://www.epa.gov/region4/superfund/programs/riskassess/ecolbul.html

Updates:

Region 4's Ecological Risk Assessment Bulletins are undergoing revision. Please contact OTS personnel

November 30, 2001: Citation for Dioxin listed under Table 3.

April 20, 2001: U.S. Fish and Wildlife Service Contacts Updated

March 9, 2000 change is: Tom Dillon is now the NOAA Coastal Resource Coordinator. See Bulletin #4.

August 11, 1999 changes were:

- deleted Preliminary Risk Evaluation Bulletin
- added soil screening Table 4
- added dioxin screening value in Table 3
- changed 4-bromophenylphenyl phthalate to 4-bromophenylphenyl ether in Table 1
- changed value of arsenic in Table 1 to 190 ug/l

INDEX

1. Ecological Introduction
2. Ecological Screening Values
   - Table 1 Freshwater Surface Water Screening Values
   - Table 2 Saltwater Screening Values
   - Table 3 Sediment Screening Values
   - Table 4 Soil Screening Values
3. Endpoint Selection
4. Natural Resource Trustees

DRAFT

Ecological Risk Assessment Bulletins

1. ECOLOGICAL INTRODUCTION

The role of a Superfund Ecological Risk Assessment is to: (1) determine whether unacceptable risks are posed to ecological receptors from chemical stressors, (2) derive contaminant levels which would not pose unacceptable risks, and (3) provide the information necessary to make a risk management decision concerning the practical need and extent of remedial action.[1]

Ecological Risk Assessment is in a beginning phase of development and therefore exists in a very dynamic state. Agency guidance is limited and there is uncertainty concerning the roles and processes of Ecological Risk Assessment in the different programs within the Agency. The Office of Technical Services (OTS) should be contacted prior to applying other programmatic guidance, policies, or practices to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Ecological Risk Assessments in Region 4.

The intention of this series of ecological bulletins is to provide regional direction for implementation of the Agency's Ecological Risk Assessment Guidance for Superfund (referred to as the Process Document).[2] This guidance supersedes the previous Risk Assessment Guidance for Superfund (RAGS), Volume II, which still may be used as a primer on the basic elements of a CERCLA Ecological Risk Assessment.[3] The Risk Assessment Forum's Framework for Ecological Risk

Assessment (referred to as the Framework document) provides the basic approach for conducting Ecological Risk Assessments used by all programs within the Agency.[4] Specific program guidance presented in these Region 4 Bulletins, as well as the Process document, may appear in rare cases to be at odds with the Framework document. Region 4 views these documents as being complementary with their focus directed at different organizational levels.

The CERCLA Ecological Risk Assessment process as outlined in the Process document consists of eight steps and five scientific/management decision points. These steps are: (1) Preliminary Problem Formulation and Ecological Effects Evaluation, (2) Preliminary Exposure Estimate and Risk Calculation, (3) Problem Formulation: Assessment Endpoint Selection and Formulation of Testable Hypothesis, (4) Conceptual Model Development: Conceptual Model Measurement Endpoint Selection and Study Design, (5) Site Assessment to Confirm Ecological Sampling and Analysis Plan, (6) Site Field Investigation, (7) Risk Characterization, and (8) Risk Management. The decision points follow steps 2 - 5, and 8.

Additional resources may be found in the Bibliography of the Process Document. Included in this list are the ECO Update bulletin series issued by the Office of Emergency and Remedial Response.[5] These bulletins are focused discussions of elements and topics related to CERCLA Ecological Risk Assessments. The guidance and direction contained in these bulletins is still somewhat broad, therefore approval of the proposed approach in CERCLA Ecological Risk Assessments should be obtained from OTS.

These regional guidance bulletins will be dynamic documents. Bulletins will be updated and new ones added as questions are posed and regional practices are developed.

This guidance does not constitute rulemaking by the Agency, and may not be relied on to create a substantive or procedural right enforceable by any other person. Region 4 reserves the right to take action that is at variance with this guidance. The intent of this guidance is to aid in the development of high-quality, single draft risk assessments consistent with the criteria of the OTS in its oversight role.

References

1. Role of the Ecological Risk Assessment in the Baseline Risk Assessment, OSWER Directive Number 9285.7-17, August 12, 1994, Laws, EP.
2. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Review Draft, September 1994.
3. Risk Assessment Guidance for Superfund, Volume II-Environmental Evaluation Manual, Interim Final, March 1989, EPA/540/1-89/001.
4. Framework for Ecological Risk Assessment, February 1992, EPA 630/F-92/001.
5. ECO Update, Intermittent Bulletin, Volumes 1 and 2, Publication 9345.0-05I.

Volume 1:

- Number 1 - The Role of BTAGs in Ecological Assessment, September 1991.
- Number 2 - Ecological Assessment of Superfund Sites: An Overview, December 1991.
- Number 3 - The Role of Natural Resource Trustees in The Superfund Process, March 1992.
- Number 4 - Developing a Work Scope for Ecological Assessments, May 1992.
- Number 5 - Briefing the BTAG: Initial Description of Setting, History, and Ecology of a Site, August 1992.

Volume 2:

- Number 1 - Using Toxicity Tests in Ecological Assessments, September 1994.
- Number 2 - Catalogue of Standard Toxicity Tests for Ecological Risk Assessment, September 1994.
- Number 3 - Field Studies for Ecological Risk Assessment, September 1994.
- Number 4 - Selecting and Using Reference Information in Superfund Ecological Risk Assessments, September 1994.

---

2. ECOLOGICAL SCREENING VALUES

Ecological screening values are based on contaminant levels associated with a low probability of unacceptable risks to ecological receptors. The Office of Technical Services (OTS) has developed the attached tables for use at Region 4 hazardous waste sites. Since these numbers are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site contaminant levels to determine if there is a need to conduct further investigations at the site. Ecological screening values should not be used as remediation levels.

Preliminary screening values for contaminants which lack Region 4 Waste Management Division Ecological Screening

Values should be proposed and submitted to the OTS for approval. If at all possible these screening values should be based on ecotoxicological information from sources such as scientific literature, computer databases, etc. As information is submitted to this office for review or as new information becomes available, these Region 4 screening values may be modified and additional screening values added.

Exceedences of the ecological screening values may indicate the need for further evaluation of the potential ecological risks posed by the site. The decision concerning the necessity for evaluation requires the weighing of such factors as the frequency, magnitude, and pattern of these exceedences. The basis of the screening values should also be considered when making the decision for the collection of additional data. An exceedence may result in the retention of that contaminant for further evaluation even though its frequency of detection may be low. The sampling may indicate a "hot spot" which would be addressed by future investigations.

Surface Water Screening Values

The surface water screening values (which exist for both Freshwater [Table 1] and Saltwater[Table 2] surface waters) were derived from the Screening Worksheet prepared by the Region 4 Water Management Division.1 These values were obtained from Water Quality Criteria documents and represent the chronic ambient water quality criteria values for the protection of aquatic life. If there was insufficient information available to derive a criterion, the lowest reported effect level was used with the application of a safety factor of ten to protect for a more sensitive species. A safety factor of ten was also used to derive a chronic value if only acute information was available.

The ambient surface water quality criteria are intended to protect 95% of the species, 95% of the time. If there is reason to believe that a more sensitive species is present at the site, such that surface water contaminant levels below the chronic ambient water quality values may pose unacceptable risks, more protective site-specific surface water screening values may be developed.

Sediment Screening Values

Sediment screening values (Table 3) are derived from statistical interpretation of effects databases obtained from the literature as reported in publications from the State of Florida, the National Oceanic and Atmospheric Administration, and a joint publication by Long et al.2,3,4 These values are generally based on observations of direct toxicity. When the Contract Laboratory Program's (CLP) practical quantification limit (PQL) is above the effect level the screening value defaults to the PQL. For those contaminants whose screening values are based on the PQL, data reported below the required quantification limit (e.g., J-flagged data) should be compared to the Effects Level number. Although the sediment screening values have been developed from a database containing information from studies conducted predominantly in marine environments, personal communication with the authors of the studies indicate that corresponding values being developed from a freshwater database are within a factor of three of the marine based numbers. The existing values will be used for freshwater sites until a separate freshwater screening value table is developed.

Soil Screening Values

Terrestrial assessments are one of the least developed aspects of Ecological Risk Assessment and screening values for this component have not been drafted by EPA. Site-specific soil screening values may be submitted based on information concerning potential effects for contaminants whose mode of toxicity is through direct exposure (e.g., soil invertebrates such as earthworms). For those contaminants which biomagnify, screening values may be back-calculated from acceptable tissue levels in prey items, through two trophic transfers from the abiotic medium. Screening values should be based on contaminant levels associated with ecological effects, instead of area or regional background levels.

Wildlife Screening Values

Wildlife screening values may serve to indicate if tissue residues pose potential risks to predatory ecological receptors (e.g., Toxicity Reference Values, TRVs). The contaminant exposure is generally expressed as a daily dietary exposure with the units of mg of contaminant, per kilogram body weight of the receptor per day (mg/kg/day). Currently there is limited information concerning tissue contaminant levels which would pose potential risks to predatory ecological receptors. Site-specific wildlife screening values may be submitted based on ecotoxicological information from sources such as scientific literature, computer databases, etc. These values may be refined, if necessary, in the Ecological Risk Assessment. The use of Food and Drug Administration (FDA) Action Levels may be used to suggest risks to ecological receptors if tissue residues exceed these values, but FDA Action Levels should not be considered protective of ecological receptors. FDA levels are derived using human health exposure assumptions from ingesting contaminated food items obtained from commercial sources (e.g., fish markets). Ecological receptors may show adverse effects at contaminant concentrations below the FDA level due to greater exposures. important factors include their: lower body weight, exposure to higher dose levels by more frequent ingestion of contaminated prey, and innate greater sensitivity

to the contaminants.

Ground Water Screening Values

The potential impacts of contaminated ground water on ecological receptors, either directly (e.g., cave-dwelling ecological receptors) or indirectly through existing or potential discharge to sediments, seeps, and surface water must be considered.

The maximum ground water contaminant concentrations should be compared to the surface water screening values as a conservative scenario (e.g., no attenuation, dilution, etc.).

References

1. 304 (a) Screening Values and Related Information, Screening List, October 1991, USEPA Region 4 - Water Management Division.
2. MacDonald Environmental Sciences, Ltd. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Florida Department of Environmental Protection. November 1994.
3. Long, ER, and LG Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52.
4. Long, ER, DD MacDonald, SL Smith, and FD Calder. 1995. "Incidence of Adverse Biological Effects with Ranges of Chemical Concentrations in Marine and Estuarine Sediments." Environmental Management 19(1): 81-97.

Table 1Table 2|Table 3|TOP|

Table 1. Region 4 Waste Management Division Freshwater Surface Water Screening Values for Hazardous Waste Sites[1]

Priority Pollutants

Compound	Acute Screening Values (ug/L)	Chronic Screening Values (ug/L)
Antimony	1300 (2s)	160 (2s)
Arsenic III	360*	190*
Beryllium	16 (6s)	0.53 (1s)
Cadmium2	1.79*	0.66*
Chromium (III)2	984.32*	117.32*
Chromium (VI)	16*	11*
Copper2	9.22*	6.54*
Lead2	33.78*	1.32*
Mercury	2.40*	0.012*3
Nickel2	789.00*	87.71*
Selenium	20.00*	5.00*
Silver2	1.23*	0.012(1s)
Thallium	140.00(3s)	4.00 (2s)
Zinc2	65.04*	58.91*
Cyanide	22*	5.2*
2,3,7,8-TCDD-Dioxin	0.1	0.00001[3
Acrolein	6.8(3s)	2.1 (1s)
Acrylonitrile	755 (4s)	75.5
Benzene	530 (7s)	53
Bromoform	2930 (2s)	293
Carbon Tetrachloride	3520 (3s)	352
Chlorobenzene	1950 (5s)	195

2-Chloroethylvinyl Etheru	35400 (1s)	3540
Chloroform	2890 (3s)	289
1,2-Dichloroethane	11800 (3s)	2000 (1s)
1,1-Dichloroethylene	3030 (3s)	303
1,2-Dichloropropane	5250 (3s)	525
1,3-Dichloropropylene (cis and trans)	606 (2s)	24.4 (1s)
Ethylbenzene	4530 (5s)	453
Methyl Bromide	1100 (1s)	110
Methyl Chloride	55000 (1s)	5500
Methylene Chloride	19300 (3s)	1930
1,1,2,2-Tetrachloroethane	932 (3s)	240 (1s)
Tetrachloroethylene	528 (5s)	84 (1s)
Toluene	1750 (5s)	175
1,2-Trans-Dichloroethylene	13500 (1s)	1350
1,1,1-Trichloroethane	5280 (2s)	528
1,1,2-Trichloroethane	3600(3s)	940(1s)
2-Chlorophenol	438 (5s)	43.8
2,4-Dichlorophenol	202 (3s)	36.5 (1s)
2,4-Dimethylphenol	212 (3s)	21.2
2-Methyl-4,6-Dinitrophenol (4,6-Dinitro-O-Cresol)	23 (4s)	2.3
2,4-Dinitrophenol	62 (3s)	6.2
2-Nitrophenol	-	3500
4-Nitrophenol	828 (3s)	82.8
3-Methyl-4-Chlorophenol(P-Chloro-M-Cersol)	3 (1s)	0.3
Pentachlorophenol[4] (pH 7.8)	20 *	13*
Phenol	1020(16s)	256 (1s)
2,4,6-Trichlorophenol	32 (3s)	3.2
Acenaphthene	170 (2s)	17
Benzidine	250 (4s)	25
Bis(2-Chloroethyl) Ether	23800 (1s)	2380
Bis(2-Ethylhexyl) Phthalate	1110 (2s)	<0.3 (2s)
4-BromophenylPhenyl Ether	36(2s)	12.2 (1s)
Butylbenzyl Phthalate	330(4s)	22 (2s)
1,2-Dichlorobenzene	158(4s)	15.8 (3s)
1,3-Dichlorobenzene	502(3s)	50.2
1,4-Dichlorobenzene	112(5s)	11.2
Diethyl Phthalate	5210(2s)	521
Dimethyl Phthalate	3300(2s)	330
Di-n-Butyl Phthalate	94(6s)	9.4
2,4-Dinitrotoluene	3100(2s)	310
1,2-Diphenylhydrazine	27(2s)	2.7
Fluoranthene	398(2s)	39.8
Hexachlorobutadiene	9(5s)	0.93(1s)

Hexachlorocyclopentadiene	0.7(4s)	0.07
Hexachloroethane	98(5s)	9.8
Isophorone	11700(2s)	1170
Naphthalene	230(4s)	62(1s)
Nitrobenzene	2700(2s)	270
N-Nitrosodiphenylamine	585(2s)	58.5
1,2,4-Trichlorobenzene	150(4s)	44.9 (1s)
Aldrin	3*	0.3
a-BHC	-	500[5]
b-BHC	-	5000[5]
g-BHC (Lindane)	2*	0.08*
Chlordane	2.4*	0.0043*3
4,4'-DDT	1.1*	0.001*
4,4'-DDE	105(1s)	10.5
4,4'-DDD	0.064(8s)	0.0064
Dieldrin	2.5*	0.0019*3
a-Endosulfan	0.22*	0.056*
b-Endosulfan	0.22*	0.056*
Endrin	0.18*	0.0023*3
Heptachlor	0.52*	0.0038*3
Heptachlor Epoxide	0.52*	0.0038*3
PCB-1242	0.2(7s)	0.014*
PCB-1254	0.2(7s)	0.014*
PCB-1221	0.2(7s)	0.014*
PCB-1232	0.2(7s)	0.014*
PCB-1248	0.2(7s)	0.014*
PCB-1260	0.2(7s)	0.014*
PCB-1016	0.2(7s)	0.014*
Toxaphene	0.73*	0.0002*3

Non-Priority Pollutants

Compound	Acute Screening Values (ug/L)	Chronic Screening Values (ug/L)
Aluminum (pH 6.5 -9.0)	750*	87*
Boron	-	750 *6
Chloride	860,000*	230,000*
Chlorine (TRC)	19*	11*
Chloropyrifos	0.083*	0.041*
Demeton	-	0.1*
Guthion	-	0.01*
Iron	-	1000*
Malathion	-	0.1*
Methoxychlor	-	0.03*

Mirex	-	0.001*
Oil and Grease	-	0.01*Low LC_{50}
Parathion	0.065*	0.013*
Pentachlorobenzene	250	50
pH	-	6.5 -9.0*
Sulfide (S_2-, HS-)	-	2*
1,2,4,5-Tetrachlorobenzene	250	50
Tributyltin	-	0.026

[1] Based on Region 4 Water Management Division, Water Quality Standards Unit's Screening List.
Hardness (mg/L as CaCO3): 50.0
pH: 6
*: Criteria
s: Number of Species

[2] Hardness Dependent Based on the following equations:

Compound	Acute Screening Value	Chronic Screening Value
Cadmium	$e^{(1.128(lnH)-3.828)}$	$e^{(0.7825(lnH)-3.49)}$
Chromium III	$e^{(0.819(lnH)+3.688)}$	$e^{(0.819(lnH)+1.561)}$
Copper	$e^{(0.9422(lnH)-1.464)}$	$e^{(0.8545(lnH)-1.465)}$
Lead	$e^{(1.273(lnH)-1.46)}$	$e^{(1.273(lnH)-4.705)}$
Nickel	$e^{(0.846(lnH)+3.3612}$	$e^{(0.846(lnH)+1.1645)}$
Silver	$e^{(1.72(lnH)-6.52)}$	
Zinc	$e^{(0.8473(lnH)+0.8604)}$	$e^{(0.8473(lnH)+0.7614)}$

[3] Based on the marketability of fish. The use of other values which may have greater ecological significance may be considered.

[4] pH Dependent. Based on the following equation:

Compound	Acute Screening Value	Chronic Screening Value
Pentachlorophenol	$e^{(1.005pH-4.83)}$	$e^{(1.005pH-5.29)}$

[5] Lowest plant value reported
[6] For long term irrigation of sensitive crops (minimum standard)

Table 1|Table 2|Table 3|TOP|

Table 2. Region 4 Waste Management Division Saltwater Surface Water Screening Values for Hazardous Waste Sites[1]

Priority Pollutants

Compound	Acute Screening Values (ug/L)	Chronic Screening Values (ug/L)
Antimony	-	-
Arsenic III	69*	36*
Beryllium	-	-
Cadmium	43*	9.3*
Chromium(III)	1030(2s)	103
Chromium(VI)	1100*	50*
Copper	2.9*	2.9*

Lead	220*	8.5*
Mercury	2.1*	0.025*[2]
Nickel	75*	8.3*
Selenium	300*	71*
Silver	2.3*	0.23(1s)
Thallium	213(3s)	21.3
Zinc	95*	86*
Cyanide	1*	1*
2,3,7,8-TCDD-Dioxin	-	0.00001[2]
Acrolein	5.5(1s)	0.55
Acrylonitrile	-	-
Benzene	1090(6s)	109
Bromoform	1790(2s)	640(1s)
Carbon Tetrachloride	15000(1s)	1500
Chlorobenzene	1050(2s)	105
2-Chloroethylvinyl Ether	-	-
Chloroform	8150(1s)	815
1,2-Dichloroethane	11300(1s)	1130
1,1-Dichloroethylene	22400(3s)	2240
1,2-Dichloropropane	24000(1s)	2400
1,3-Dichloropropylene(cis and trans)	79(2s)	7.9
Ethylbenzene	43(5s)	4.3
Methyl Bromide	1200(1s)	120
Methyl Chloride	27000(1s)	2700
Methylene Chloride	25600(2s)	2560
1,1,2,2-Tetrachloroethane	902(2s)	90.2
Tetrachloroethylene	1020(1s)	45(1s)
Toluene	370(5s)	37
1,2-Trans-Dichloroethylene	-	-
1,1,1-Trichloroethane	3120(2s)	312
1,1,2-Trichloroethane	-	-
2-Chlorophenol	-	-
2,4-Dichlorophenol	-	-
2,4-Dimethylphenol	-	-
2-Methyl-4,6-Dinitrophenol(4,6-Dinitro-O-Cresol)	-	-
2,4-Dinitrophenol	485(3s)	48.5
2-Nitrophenol	-	-
4-Nitrophenol	717(2s)	71.7
3-Methyl-4-Chlorophenol(P-Chloro-M-Cresol)	-	-
Pentachlorophenol[3]	13*	7.9*
Phenol	580(4s)	58
2,4,6-Trichlorophenol	-	-
Acenaphthene	97(2s)	9.7

Benzidine	-	-
Bis(2-Chloroethyl) Ether	-	-
Bis(2-Ethylhexyl) Phthalate	-	-
4-BromophenylPhenylEther	-	-
Butylbenzyl Phthalate	294.4(2s)	29.4
1,2-Dichlorobenzene	197(3s)	19.7
1,3-Dichlorobenzene	285(2s)	28.5
1,4-Dichlorobenzene	199(2s)	19.9
Diethyl Phthalate	759(2s)	75.9
Dimethyl Phthalate	5800(2s)	580
Di-n-Butyl Phthalate	-	3.4[4]
2,4-Dinitrotoluene	-	-
1,2-Diphenylhydrazine	-	-
Fluoranthene	4(2s)	1.6(1s)
Hexachlorobutadiene	3.2(4s)	0.32
Hexachlorocyclopentadiene	0.7(6s)	0.07
Hexachloroethane	94(2s)	9.4
Isophorone	1290(1s)	129
Naphthalene	235(3s)	23.5
Nitrobenzene	668(2s)	66.8
N-Nitrosodiphenylamine	330000(1s)	33000
1,2,4-Trichlorobenzene	45(2s)	4.5
Aldrin	1.3*	0.13
a-BHC	-	1400[4]
b-BHC	-	-
g-BHC(Lindane)	0.16*	0.016
Chlordane	0.09*	0.004*2
4,4'-DDT	0.13*	0.001*
4,4'-DDE	1.4(1s)	0.14
4,4'-DDD	0.25(3s)	0.025
Dieldrin	0.71*	0.0019*2
a-Endosulfan	0.034*	0.0087*
b-Endosulfan	0.034*	0.0087*
Endrin	0.037*	0.0023*2
Heptachlor	0.053*	0.0036*2
Heptachlor Epoxide	0.053*	0.0036*2
PCB-1242	1.05(3s)	0.03*
PCB-1254	1.05(3s)	0.03*
PCB-1221	1.05(3s)	0.03*
PCB-1232	1.05(3s)	0.03*
PCB-1248	1.05(3s)	0.03*
PCB-1260	1.05(3s)	0.03*

PCB-1016	1.05(3s)	0.03*
Toxaphene	0.21*	0.0002*2

Non-Priority Pollutants

Compound	Acute Screening Values (ug/L)	Chronic Screening Values (ug/L)
Aluminum(pH 6.5 - 9.0)	-	-
Ammonia	5	5
Boron	-	-
Chloride	-	-
Chlorine(TRC)	13*	7.5*
Chloropyrifos	0.011*	0.0056*
Demeton	-	0.1*
Guthion	-	0.01*
Iron	-	-
Malathion	-	0.1*
Methoxychlor	-	0.03*
Mirex	-	0.001*
N-nitrosopyrrolidene	3300000	-
Oil and Grease	-	0.1*Low LC_{50}
Parathion	1.78(2s)	0.178
Pentachlorobenzene	160	129
Phosphorus(elemental)	-	0.1*
pH	-	6.5 - 8.5
Sulfide(S2-, HS-)	-	2
1,2,4,5-Tetrachlorobenzene	160	129
Tributyltin(Advisory)	-	0.01

[1]Based on Region IV Water Management Division, Water Quality Standards Unit's Screening List.
* : Criteria
s : Number of Species
[2] Based on the marketability of fish. The use of other values which may have greater ecological significance may be considered.

[3] pH Dependent. Based on the following equation:

Compound	Acute Screening Value	Chronic Screening Value
Pentachlorophenol	e(1.005pH-4.83) e(1.005pH-5.29)	

[4] Lowest Plant Value Reported
[5] See table-Ambient WQCrit.-Ammonia(Salt H2O)440/5-88-004

Table 1|Table 2|Table 3|TOP|

Table 3. Region 4 Waste Management Division Sediment Screening Values for Hazardous Waste Sites.

Metals (ppm)

Chemical Analyte	Effects Value	CLP PQL[1]	Screening Value
Antimony	2[2]	12	12
Arsenic	7.24[3]	2	7.24

Cadmium	0.676[3]	1	1
Chromium	52.3[3]	2	52.3
Copper	18.7[3]	5	18.7
Lead	30.2[3]	0.6	30.2
Mercury	0.13[3]	0.02	0.13
Nickel	15.9[4]	8	15.9
Silver	0.733[3]	2	2
Zinc	124[3]	4	124

Organics (ppb)

Chemical Analyte	Effects Value	CLP PQL[1]	Screening Value
p,p'- DDD	1.22[3]	3.3	3.3
DDD	2[2]	3.3	3.3
p,p'- DDE	2.07[3]	3.3	3.3
DDE	2[2]	3.3	3.3
p,p'- DDT	1.19[3]	3.3	3.3
DDT	1[2]	3.3	3.3
Total DDT	1.58[4]	3.3	3.3
Chlordane	0.5[2]	1.7	1.7
Dieldrin	0.02[2]	3.3	3.3
Endrin	0.02[2]	3.3	3.3
Lindane(gamma- BHC)	0.32[3]	3.3	3.3
Total PCBs	21.6[3]	33(67for Aroclor1221)	33(67for Aroclor1221)
Bis(2-ethylhexyl)phthalate	182[3]	3.6	182
Acenaphthene	6.71[3]	330	330
Acenaphthylene	5.87[3]	330	330
Anthracene	46.9[3]	330	330
Fluorene	21.2[3]	330	330
2- Methyl Naphthalene	20.23	330	330
Naphthalene	34.6[3]	330	330
Phenanthrene	86.7[3]	330	330
Low Molecular Weight PAHs	312[3]	330	330
Benzo(a)anthracene	74.8[3]	330	330
Benzo(a)pyrene	88.8[3]	330	330
Chrysene	108[3]	330	330
Dibenzo(a,h)anthracene	6.22[3]	330	330
Fluoranthene	113[3]	330	330
Pyrene	153[3]	330	330
High Molecular Weight PAHs	655[3]	330	655
Total PAHs	1684[3]	330	1684
Dioxin (ng/kg)			2.5

1. Contract Laboratory Program Practical Quantification Limit
2. Long, Edward R., and Lee G. Morgan. 1991. The Potential for Biological Effects of Sediment-Sorbed Contaminants Tested in the National Status and Trends Program. NOAA Technical Memorandum NOS OMA 52
3. MacDonald, D.D. 1994. Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Florida Department of Environmental Protection.
4. Long, Edward R., Donald D. MacDonald, Sherri L. Smith, and Fred D. Calder. 1995. Incidence of Adverse Biological Effects within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management 19(1):81-97.
5. USEPA. 1993. Interim Report on Data and Methods for Assessment of 2,3,7,8 - Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife. EPA/600/R-93/055.

)**Table 4. Region 4 Waste Management Division Soil Screening Values for Hazardous Waste Sites (PDF)** (4 pp, 80K, About PDF)

---

1. Ecological Introduction
2. Ecological Screening Values
   - Table 1 Freshwater Surface Water Screening Values
   - Table 2 Saltwater Screening Values
   - Table 3 Sediment Screening Values
   - Table 4 Soil Screening Values
3. Endpoint Selection
4. Natural Resource Trustees

3. ENDPOINT SELECTION

An Ecological Risk Assessment (ERA) should be conducted at a hazardous waste site if the result of the Preliminary Risk Evaluation (PRE, see Ecological Risk Assessment 1) indicates that there is a likelihood of impacts to ecological receptors from exposure to site related contaminants. The first and most important step in the ERA is the selection of appropriate assessment and measurement endpoints. Assessment and measurement endpoint selection is discussed in detail in Chapters 3 and 4 of the Process Document, along with other components of the ERA planning process such as defining testable hypotheses, formulating the site conceptual model and designing the field study.1

The following definitions of assessment and measurement endpoints are contained in Risk Assessment Guidance for Superfund: Volume II, Environmental Evaluation Manual, Interim Final2. An assessment endpoint is the explicit expression of an environmental value that is to be protected. A measurement endpoint is a measurable ecological characteristic that is related to the environmental value chosen as the assessment endpoint.

An easy way to envision the difference between assessment and measurement endpoints is to consider the decline in numbers of some species of piscivorous birds such as the bald eagle (Haliaeetus leucocephalus), brown pelican (Pelicanus occidentalis) and osprey (Pandion haliaetus) which was well documented 20 years ago. This phenomenon was caused at least in part by decreased reproduction due to egg shell thinning induced by dietary exposure to DDT in forage fish.

If one were conducting an ERA at a hazardous waste site where DDT has migrated into a surface water body, an assessment endpoint could be the maintenance of reproductive success in a population of piscivorous birds which utilizes the contaminated aquatic system as a foraging area. The measurement endpoint in this case would be concentrations of DDT in forage fish tissue consumed by piscivorous birds. Measured (not modeled, as in the PRE) concentrations of DDT residues in forage fish tissue from the contaminated area could be converted to a daily dose using life history and ingestion rate parameters for the piscivorous bird being considered. This exposure level could then be compared with a literature derived Toxicity Reference Value (TRV) for DDT related to eggshell thinning in the ecological receptor species. Resultant hazard quotients (HQ, see Ecological Risk Assessment 1) would indicate the magnitude of potential risks to receptors from consumption of contaminated fi! sh.

One problem with using fish tissue residues as a measurement endpoint is that fish are mobile and many species are migratory. Tissue residue levels could be due to site contamination, area-wide (background) contamination, or another source. It is important, therefore, to obtain tissue samples from non-migratory fish which have a small home range relative to the contaminated area.

The results of the PRE should aid in the selection of assessment and measurement endpoints, however, for the ERA, additional literature review is usually required to better define stressor characteristics (e.g., fate and transport), receptor specific effects, toxicity and the most appropriate endpoints to be evaluated.

Following assessment and measurement endpoint selection and development of a testable hypothesis and site conceptual model, a study plan is designed to ensure that adequate data are collected to support the ecological component of the Baseline Risk Assessment and Remedial Investigation and Feasibility Study (RI/FS). There are a limited number of fundamental approaches for conducting site specific investigations on ecological impacts of hazardous substances. Tissue residue studies, population or community evaluations and toxicity testing are the three methodologies most commonly used. The appropriate methodology will depend on the assessment and measurement endpoints selected in the previous steps. However, none of the methods can be successful without a full understanding of the ecotoxicological properties of the contaminants, their migration pathways, and complete exposure routes at the site.

Tissue residue studies are most useful for predicting ecological risk from contaminants which bioaccumulate or biomagnify in the food web, resulting in impacts to upper trophic level receptors via the ingestion pathway. In the DDT example above, whole body residue analysis of forage fish likely to be consumed by piscivorous birds would be the most appropriate methodology to assess the measurement endpoint.

Toxicity testing is most commonly employed to determine potential risk via direct contact with contaminated surface water, soil or sediment. Toxicity testing must be carefully designed to ensure that the proper test species are used for the environmental medium being evaluated. For example, a benthic macroinvertebrate such as Hyalella should be used as a test subject in freshwater sediment toxicity tests rather than a free-swimming organisms such as Ceriodaphnia.

Community or population evaluations involve floral or faunal field surveys and the computation of species diversity and richness indices. Results of these studies should not be used as measurement endpoints for a hazardous waste site ERA because the various diversity and richness indices were not developed to measure ecological impacts of hazardous materials in the environment. Natural variability in population and community structure, lack of sensitivity of some species to some contaminants and impacts to population/community structure from non-chemical stressors make the interpretation of these studies difficult in the context of assessing ecological impacts of hazardous waste sites.

Conducting an ERA as presented in the Process Document involves a focus of time and work in the planning phase and the selection of assessment and measurement endpoints. This is necessary in order to design an ERA which will allow an adequate understanding of potential risks at the site and provide enough information to establish site clean up goals for protection of ecological resources.

References

1. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Review Draft. September 1994.
2. Risk Assessment Guidance for Superfund, Volume II. Environmental Evaluation Manual. Interim Final. March 1989, EPA/540/1-89/001.

---

1. Ecological Introduction
2. Ecological Screening Values
   - Table 1 Freshwater Surface Water Screening Values
   - Table 2 Saltwater Screening Values
   - Table 3 Sediment Screening Values
   - Table 4 Soil Screening Values
3. Endpoint Selection
4. Natural Resource Trustees

4. NATURAL RESOURCE TRUSTEES

The participation of the natural resource trustees (state, federal, including federal departments managing resources potentially impacted by NPL sites such as the departments of Defense, Energy, Interior, or Agriculture, or other entities, e.g. Native American tribes) in the CERCLA process is not only encouraged but required. Early notification of natural resource trustees by the site managers (e.g. RPMs, OSCs) should produce more efficient investigations of NPL sites and result in more timely decisions. In addition, early notification will provide the initial information to assist the natural resource trustees in completing their mandates and responsibilities in determining impacts to their trust resources.

FEDERAL NATURAL RESOURCE TRUSTEES

Department of the Interior

The Office of Environmental Compliance and Planning (OEPC) is the natural resource trustee contact for the Department of Interior (DOI). The Regional Environmental Officer in DOI'S Region 4 is located in Atlanta and is the individual who should be contacted. The Department of Interior agencies include the United States Fish and Wildlife Service, the

United States Geological Survey, the National Park Service, the Minerals Management Service, the Bureau of Reclamation, Bureau of Land Management, and the Bureau of Indian Affairs. The DOI agency which is most often involved with ecological impacts of hazardous waste sites is the United States Fish and Wildlife Service (USFWS). The regional USFWS for the Region 4 states is also located in Atlanta. A listing of the regional and field office contaminant specialist contacts is included.

National Oceanic and Atmospheric Administrations

The Secretary of the Department of Commerce has delegated the natural resource trustee responsibilities to the Administrator of the National Oceanic and Atmospheric Administration (NOAA). NOAA is represented in the EPA Region 4 office by the Coastal Resource Coordinator.

Other Federal Agencies

Federal agencies which own or manage land or resources potentially impacted by the release of contaminants will also have a natural resource trustee role. Examples include the Department of Defense, which is a trustee for all military installations; the Department of Energy, which is a trustee for their facilities; the Department of Agriculture, which is a trustee for sites which would impact land they manage, such as national forests or their laboratories; and the Department of Interior, National Park Service, which is a trustee for land that they manage (e.g. national parks and monuments).

STATE NATURAL RESOURCE TRUSTEES

The State Governor designates certain state officials as trustees for those natural resources belonging to, or controlled by the State. The state natural resource trustee responsibilities may be divided among the state regulatory agency, the state wildlife and fisheries agency, and the office of the Governor. A list of the trustees for the states in Region 4 is attached.

OTHER TRUSTEES

Other entities which may serve a trustee function include American Indian tribes whose property may be impacted by an NPL site.

NATURAL RESOURCE DAMAGE ASSESSMENTS

If there has been injury or lost use of natural resources due to an NPL site, the natural resource trustees may sue for damages to restore resources. Ideally the remedy selected for an operable unit at a site will reduce the risks posed to ecological receptors to acceptable levels, including those trust resources under the jurisdiction of the natural resource trustees. However, EPA and the natural resource trustees may disagree on the protectiveness of the selected remedy. This disagreement may be due to a difference of opinion concerning contaminant levels which are protective of ecological receptors, or pertaining to the balancing of the beneficial aspects of the remedy in reducing contaminant levels to acceptable risk levels versus its detrimental aspects such as habitat destruction. This balance may result in remedial goals which exceed the contaminant concentrations posing risks to the receptor in terms of contaminant exposure exclusively. injury due to these residual levels of contamination.

The natural resource damage assessment process is the responsibility of the natural resource trustees and does not involve EPA. The data and information collected in the Ecological Risk Assessment process which may be useful to the natural resource trustees are available. However, elements which are strictly supportive of the natural resource damage assessment process will not be approved as part of the Ecological Risk Assessment or Remedial Investigation Work Plan. Any work elements strictly supporting the Natural Resource Damage Assessment should be segregated into a separate document, or at least in an appendix, and their purpose should be clearly stated.

ENDANGERED SPECIES ACT

The Endangered Species Act is a potential ARAR (applicable or relevant and appropriate requirements) for all NPL sites. The party conducting the Remedial Investigation should contact all appropriate state and Federal natural resource trustees, and their representatives (such as USFWS), to determine the potential presence of threatened and endangered species or their critical habitat.If the trustee agency or their representative determines a threatened or endangered species, or their critical habitat is present or potentially present, a survey of the appropriate area should be conducted. The appropriate area may extend past the "boundaries" of the site (e.g., to account for the utilization of the site from an off-site nesting location). The qualifications of the party conducting the survey should be presented to the trustee agency or their representative for approval. The results of the survey should be presented to the trustee agency, or their representative, for their concurrence. This interaction is among the various components of an informal Section 7 consultation.. If it is determined that a threatened or endangered species is utilizing the site, or may utilize it in the future, a finding concerning the likelihood of effects due to site-related contaminants or activities should be

presented to the trustee agency, or their representative.

The informal Section 7 consultation allows a time period for the trustee, or their representative, to determine if a formal Section 7 consultation will be required. A "may effect" finding in the informal Section 7 consultation will trigger a formal Section 7 consultation. Information contained in the Ecological Risk Assessment may be used in reaching the resolution of this issue if the threatened or endangered species possesses life history characteristics, susceptibility, or exposure to the site-related contaminants making them representative of an appropriate endpoint for the Ecological Risk Assessment.

Federal Natural Resource Trustees

Department of Commence
Coastal Resource Coordinator
National Oceanic and Atmospheric Administration
c/o USEPA Region 4, 4WD-OTS
61 Forsyth St. SW
Atlanta, GA 30303
Current Contact - Tom M. Dillon, Coastal Resource Coordinator
Telephone: 404/562-8639
FAX: 404/562-8662

Department of Interior
Office of Environmental Compliance and Planning
Regional Environmental Officer
United States Department of Interior
Office of Environmental Compliance and Planning
75 Spring Street, SW, Suite 306
Atlanta, GA 30303
Current Contact - Jim Lee, Regional Environmental Officer
Greg Hogue, Assistant Regional Environmental Officer
Telephone: 331-4524
FAX: 331-1736

Fish and Wildlife Service, Southeast Region
Ecological Services Field Offices Contact Information (Environmental Contaminants)

Alabama
1208-B Main Street (P.O. Drawer 1190)
Daphne, AL 36526
Telephone: 334.441.5181 Fax: 334.441.6222
Field Supervisor: Mr. Larry Goldman (x. 30) e-mail: larry_goldman@fws.gov
EC Biologist: Vacant (x. 31) e-mail: @fws.gov

Arkansas
1500 Museum Road, Suite 105
Conway, AR 72032
Telephone: 501.513-4470 Fax: 501.513.4480
Field Supervisor: Mr. Allan Mueller (4475) e-mail: allan_mueller@fws.gov
EC Biologist: Dr. Jim Warren (4482) e-mail: jim_warren@fws.gov

Florida--Panama City
1601 Balboa Avenue
Panama City, FL 32405
Telephone: 850.769.0552 Fax: 850.763.2177
Field Supervisor: Ms. Gail Carmody (x. 225) e-mail: gail_carmody@fws.gov
EC Biologist: Mr. Mike Brim (x. 232) e-mail: michael_brim@fws.gov

Florida--Jacksonville
6620 Southpoint Drive, South
Suite 310
Jacksonville, FL 32216-0912
Telephone: 904.232.2580 Fax: 904.232.2404
Field Supervisor: Mr. Dave Hankla (x. 108) e-mail: dave _hankla@fws.gov
Note: The Jacksonville field office does not currently have an EC Biologist. Contact the Field Supervisor

Florida--Vero Beach
1339 20th Street

Vero Beach, FL 32960
Telephone: 561.562-3909 Fax: 561.562-4288
Field Supervisor: Mr. Jay Slack (x. 234) e-mail: jay_slack@fws.gov
EC Biologist: Dr. Bob Frakes (x. 242) e-mail: robert_frakes@fws.gov
Assistant EC Biologist: Jim Boggs (x. 223) e-mail: jim_boggs@fws.gov

Georgia-Athens
240 South Milledge Avenue
Athens, GA 30605
Telephone: 706.613.9493 Fax: 706/613-6059
Field Supervisor: Ms. Sandy Tucker (x. 30) e-mail: sandy_tucker@fws.gov

Georgia-Brunswick
4270 Norwich Street
Brunswick, GA 31520-2523
Telephone: 912.265.9336 Fax: 912.265.1061 Cell: 912.266.3706
Assistant Field Supervisor/EC Biologist: Dr. Greg Masson (x. 30)
e-mail: greg_masson@fws.gov
Assistant EC Biologist: Ms. Karen Salomon (x. 31) e-mail: karen_salomon@fws.gov
Laboratory Manager: Jeff Gardner (x. 21) e-mail: jeff_gardner@fws.gov

Kentucky/Tennessee
446 Neal Street
Cookeville, TN 38501
Telephone: 931.528.6481 Fax: 931.528.7075
Field Supervisor: Dr. Lee Barclay (x. 212) e-mail: lee_barclay@fws.gov
EC Biologist: Mr. Steve Alexander (x. 210) e-mail: steven_alexander@fws.gov
Cellular phone: 931.260.1906
Asst. EC Biologist: Laila Lienesch e-mail: laila_lienesch@fws.gov

Louisiana
646 Cajundome Blvd.
Suite 400
Lafayette, LA 70506
Telephone: 337.291.3100 Fax: 337.291.3139
Field Supervisor: Mr. David Fruge (3115) e-mail: dave_fruge@fws.gov
Primary Spill Responder: Mr. Buddy Goatcher (3125) e-mail: buddy_goatcher@ fws.gov
Cell Phone: 337.280.1157
EC Biologist: Mr. Paul Conzelmann (3126) e-mail: paul_conzelmann@fws.gov

Mississippi
6578 Dogwood View Parkway, Suite A
Jackson, Mississippi 39213
Telephone: 601.965.4900 Fax: 601.965.4340
Field Supervisor: Ray Aycock (x. 23) e-mail: ray_aycock@mail.fws.gov
EC Biologist: Mr. Lloyd Inmon e-mail: lloyd_inmon@fws.gov

North Carolina
Street Address: 551-F Pylon Drive, Raleigh, NC 27606
Mailing Address: P.O. Box 33726, Raleigh, NC 27636-3726
Telephone: 919.856.4520 Fax: 919.856.4556
Field Supervisor: Dr. Garland Pardue (x. 11) e-mail: garland_pardue@fws.gov
EC Biologist: Mr. Tom Augspurger (x. 21) e-mail: tom_augspurger@fws.gov
Presidential Management Intern

Puerto Rico/Virgin Islands
Carr 301, KM 5.1, Bo Corozo
P.O. Box 491
Boqueron, PR 00622
Telephone: 787.851.7297 x. 26 Fax: 787.851.7440
Field Supervisor: Mr. James Oland e-mail: james_oland@fws.gov
EC Biologist: Mr. Felix Lopez e-mail: felix_lopez@fws.gov
Cell Phone: 787.510.5208

South Carolina
U.S. Fish and Wildlife Service

176 Croghan Spur Road
Suite 200
Charleston, SC 29407
Telephone: 843.727.4707 Fax: 843.727.4218
Field Supervisor: Mr. Roger Banks (x. 15) e-mail: roger_banks@fws.gov
EC Biologist: Ms. Diane Duncan (x. 29) e-mail: diane_duncan@fws.gov
Alternate Work No.: 843.559.7909
Asst. EC Biologist: Mr. Russell Jeffers (x. 20) e-mail: russell_jeffers@fws.gov

Regional Environmental Contaminants Program Coordinator
W. Allen Robison, Ph.D.
1875 Century Blvd, Suite 200 (Ecological Services)
Atlanta, Georgia 30345
Telephone: 404.679.7127 Fax: 404.679.7081 e-mail: allen_robison@fws.gov

Regional Spill Response/NRDAR Coordinator
Dr. Diane Beeman
1875 Century Blvd, Suite 200 (Ecological Services)
Atlanta, Georgia 30345
Telephone: 404.679.7094 Fax: 404.679.7081 e-mail: diane_beeman@fws.gov
Cell Phone: 404.895.7093 Pager: 888.518.8424

Additional Contacts

US Department of Interior Contacts--Southeast Region
Mr. Jim Lee (Regional Environmental Officer)
Mr. Greg Hogue
US Department of Interior
Office of Environmental Policy and Compliance
Richard B. Russell Federal Building, Room 306
Atlanta, GA 30303
Telephone: 404.331.4524 Fax: 404.331.1736

U. S. Fish and Wildlife Service
Division of Environmental Quality
4401 North Fairfax Drive, Room 322
Arlington, VA 22203
Everett Wilson, Chief
Mary Henry, Deputy Chief
National Spill Response Coordinator--Vacant
703.358.2148 (t)
703.358.1800 (f)

FWS Liaisons to EPA:
U. S. Fish and Wildlife Service
c/o USEPA
Environmental Response Team
2890 Woodbridge Ave., Bldg. 18
Edison, NJ 08837
Ken Seeley (732.906.6987)
Mark Huston (732.321.6609)

USEPA/Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303
Mr. Lynn Wellman (404.562.8647)

National Response Center: 800.424.8802

State Trustee Designations to Section 107 of CERCLA January 30, 1995

Alabama Trustees:

Mr. James D. Martin, Commissioner
Department of Conservation and Natural Resources
64 N. Union St.
Montgomery, AL 36130
Telephone: 205/242-3486

Mr. Leigh Pegues, Director
Department of Environmental Management
1751 Congressman W.L. Dickinson Dr.
Montgomery, AL 36130
Telephone: 205/271-7700

Dr. Ernest Mancini, State Geologist
Oil and Gas Board
P.O. Drawer O
Tuscalossa, AL 35486
Telephone: 205/349-2852

Florida Trustee:

Ms. Virginia Wetherell, Secretary
Department of Environmental Protection
Marjorie Stoneman Douglas Building
3900 Commonwealth Blvd., MS 10
Tallahassee, FL 32399-2400
Telephone: 904/488-1554

Georgia Trustee:

Harold F. Reheis, Director
Environmental Protection Division
Department of Natural Resources
Floyd Tower East, Suite 1154
205 Butler Street
Atlanta, GA 30334
Telephone: 404/656-7802

Kentucky Trustee:

William C. Eddins, Commissioner
Natural Resources and Environmental Protection Cabinet
Department for Environmental Protection
Frankfort Office Park
18 Reilly Road
Frankfort, KY 40601
Telephone: 502/564-3035

Mississippi Trustee:

Trudy Fisher, Executive Director
Department of Environmental Quality
P.O. Box 20305
Jackson, MS 39209
Telephone: 601/961-5000

North Carolina Trustee:

Jonathan B. Howes, Secretary
Department of Environment, Health, and Natural Resources
P.O. Box 27687

512 N. Salisbury
Raleigh, NC 27611-7687
Telephone: 513/733-4984
(Note: Richard Whisnant, General Counsel, is contact)

South Carolina Trustees:

Mr. Ron Kinney, Director
Waste Assessment and Emergency Response
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
Telephone: 803/896-4000

Mr. J. Keith Lindler, Director
Division of Site Assessment and Remediation
Bureau of Solid and Hazardous Waste
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
Telephone: 803/896-4000

Ms. Beth Partlow
Office of the Governor
1205 Pendleton St., Suite 333
Columbia, SC 29201
Telephone: 803/734-0543

Mr. Ed Duncan
Marine Resources Center
South Carolina Department of Natural Resources
Post Office Box 12559
Charleston, SC 29422-2559
Telephone: 803/762-5014

Tennessee Trustee:

Mr. Don Dills, Commissioner
Department of Environment and Conservation
701 Broadway
Nashville, TN 37243-0435
Telephone: 615/742-6747

USEPA/Region 4
Atlanta Federal Center
61 Forsyth Street, SW
Atlanta, GA 30303
Ms. Sharon Thoms (404.562.8666)

National Response Center: 800.424.8802

TOP